FAST Education/Outreach Implementation Plan

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Summary Goals and Plans

The FAST Mission provides wonderful opportunities to inspire the public and educate students about the physics of the aurora.

Goals

Using a wide variety of education and public outreach (E/PO) activities and resources, our goals are to:

- disseminate widely the most recent discoveries by FAST and news about the aurora to the general public and to students,
- teach middle and high school teachers and students across the country about electric fields that accelerate electrons and ions in the auroral acceleration region,
- teach elementary school teachers and students across the country about the motion and location of the aurora together with Ruth Paglierani at the Sun-Earth Connection Education Forum (SECEF) of NASA,
- ensure that our lessons are aligned with National Science Education Standards (NSES),
- address under-served communities using FAST science to motivate and inspire, and
- inspire students toward a career in space physics by teaching undergraduate students at UC Berkeley about the day-to-day operation of a space mission while they are working at the Mission Operation Center (MOC) with Manfred Bester and Tim Quinn.

Plans

EPO Specific Plans (~2 months per year of L. Peticolas' time)

In the next three years we plan to meet these goals by:

- updating the FAST E/PO website to include the most recent lessons, news about FAST discoveries, and auroral events,
- participating in public events, such as the Sun-Earth day on Spring Equinox, UCB Cal Day open house, and the Venus Transit affair, together with the SECEF, THEMIS E/PO, and STEREO-IMPACT E/PO teams,
- working with the Lawrence Hall of Science (LHS) and Star Lab to reach teachers and to disseminate the PASS Vol 13, Northern Lights Planetarium Show requested by planetaria across the country,
- organizing opportunities for FAST researchers to give talks at middle and high schools and community colleges with under-served students (in the California cities of Richmond, Oakland, and San Pablo),
- developing a lesson plan for grades 9-14 about electric fields, ions, and electrons in a converging magnetic field, which will align with the following NSES:
    understanding of and involvement in inquiry, structure of atoms, motions and forces, transfer of energy, conservation of energy, interactions of energy and matter, electricity and magnetism, energy in the earth system, natural hazards, and science as a human endeavor,

- advising in the development of a lesson plan for grades K-6 about the motion of the aurora and about the location of the aurora by Ruth Paglierani at the Sun-Earth Connection Education Forum (SECEF) of NASA, which will align with the following NSES:
    understanding of and involvement in inquiry, position and motion of objects, light, objects in the sky, changes in earth and sky, and science as a human endeavor,
- participating at the National Science Teachers Association (NSTA), the Society for Advancement of Chicanos and Native Americans in Science (SACNAS) teacher professional workshops as well as the national teacher workshops held at UCB and LHS, which will include sharing aurora lessons and discoveries and disseminating the new FAST lithograph,
- using the expertise of the scientists in the FAST team to ensure the physics in the lessons is correct and associated with the new discoveries of FAST,
- participating in the yearly "Share the Future" and "Expanding Your Horizons", which are programs in Minnesota and California to introduce 300-600 6^{th}-12^{th} grade girls to careers in math and science, and
- working with the THEMIS EPO team to share discoveries about the aurora to Native Americans in 9 states and Indigenous Peoples in Alaska.

Mission Plans aligned with EPO (not in EPO budget-in kind)

In the next three years the FAST science and operation teams will help to meet these goals by:

- continuing to educate teachers about the aurora and FAST discoveries through the Research for Education of Teachers (RET) program at UMinn, and
- continuing to teach undergraduate students about auroral science and the day-to-day operation of a space mission while they work with FAST researchers and in the mission operation center (MOC).

Evaluation

We will assess whether we have met these goals by:

- collecting statistics tallying the number of hits on our web page and finding out from where they come,
- sending a follow-up survey to the planetaria who request the Northern Lights show we provided through Jane Sadler at Star Lab,
- tracking the Lithographs we hand out,
- having students take pre- and post-quizes when a FAST researcher gives a talk in a classroom,
- testing lessons in the classroom, sending the lesson to be reviewed by NASA's product review program, and providing a form for teachers to give feedback when they use our lessons, and
- contracting Lisa Kala, the Director of Excellence Through Collaboration Opportunities (ETCO) of the UCB school of education to develop forms we will use to evaluate both formative and summative effectiveness of our teacher workshops and the lasting results of our lessons.

Partners and Leverage Opportunities

Dr. L. Peticolas, who is an auroral scientist herself as well as an E/PO specialist working on STEREO-IMPACT and THEMIS, will be the E/PO Lead for FAST and will devote a little less than 2 months/yr (15% of her time) to working on E/PO FAST. She will do most of the lesson development, web page modifications, and interaction with middle and high school teachers.

Without the help of many partners, this E/PO plan would not be possible. A. Gould at the LHS and J. Sadler at Star Lab in Boston, MA will help with the dissemination and information pertaining to the use of the Northern Lights Planetarium Show. Dr. L. Kala of ETCO at UCB will help with the assessment and evaluation of the teacher workshops. The SEGway team, Dr. N. Craig and Dr. B. Mendez, at UCB are involved in E/PO for the following relevant NASA missions: THEMIS, STEREO-IMPACT, and RHESSI, and L. Peticolas will work together with them at teacher workshops and other mission events such as Cal Day at UCB. R. Paglierani of the SECEF UCB team will be the main creator of the elementary school aurora lessons. The FAST involvement in the RET program at UMinn will be organized by Dr. C. Cattell of the FAST science team. And other scientists on the FAST team, e.g. PI Dr. C. Carlson, Co-Is Dr. J. McFadden, Dr. R. Ergun, Dr. J. Bonnell, and engineers, e.g. M. Bester and T. Quinn on the FAST team will hire, teach, and interact with the undergraduates at UCB and University of Colorado at Boulder. With these partners we will be able to be very effective with the limited budget we have to work with.

Timeline of Proposed Activities and Assessments

2003-2004

Formal Education

In this first year, we will meet further with Dr. Kala to discuss the type of assessments we would like to do with the teacher workshops both during the workshops and after the teachers have returned to their own classrooms. In this year she will come up with forms for us to use to make these assessments. She will also give us some advice on how to reach under-served students.

We will help advise the K-6 grade aurora lessons around motion and location of the aurora and start the development of the high school and junior college (9-14 grade) electric field lesson.

At the SACNAS conference where we will be giving a teachers workshop as part of the STEREO-IMPACT, RHESSI and CHIPS Mission E/POs, we will hand out the FAST lithograph and discuss the physics of the aurora.

Informal Education

We will work with LHS and Star Lab to mail out the Northern Light Shows to Planetaria around the country as they request it.

Public Outreach

We will update the FAST E/PO web page with science discoveries as we collect statistics about the use of this web page over the previous year. In addition to the web page, we will participate in the public events mentioned above such as Cal Day at UCB open-house in April, 2004, including the Venus Transit event in June, 2004. At these events, we will hand out the FAST lithograph.

2004-2005

Formal Education

In this year, we will help to organize and lead two teacher workshops: one in association with the THEMIS EPO LHS GEMS site in Nevada in the Fall of 2004 and one associated with the SECEF workshop held at UCB in the summer of 2005. We will make use of Dr. Kala's assessment forms in these workshops. We will also hand out FAST lithographs and share the physics of the aurora.

We will also complete the high school lesson on electric fields in the aurora, print it, and test it in the classroom. At the same time we will help in submitting the SECEF K-6 motion and location of the aurora lesson to NASA's product review program.

During this year we will also organize talks in classrooms by FAST researchers and ensure that the pre- and post-quizzes are given to the students. We will write up a report on the results from the quizzes.

Informal Education

Star Lab will send out the remaining Northern Lights Shows. We will send out follow-up surveys developed by Dr. Kala to determine the audience that we have reached and the frequency of use of the planetarium show.

Public Outreach

We will continue to update the FAST EPO web page and collect statistics on its use. And we will help to put the K-6 motion and location of the aurora lesson up on the web. We will continue to attend public outreach events as in the previous year, e.g. Cal Day UCB open-house in April 2005, minus the Venus Transit event, handing out lithographs.

2005-2006

Formal Education

This year we will submit the 9-14 grade lesson to NASA's product review program and print several copies of the lesson. In the spring of 2006 we will use FAST funds to present the high school lesson on electric fields at the NSTA meeting. Again the evaluation forms will be used and we will write up a report with the results from the forms in order to assess the benefits of these workshops.

We will organize more trips to under-served schools by FAST researchers using the quizzes as a means to assess the effectiveness of the talks.

Informal Education

We will send out the final follow-up surveys to the planetaria regarding the Northern Lights Show and write up a report with our findings.

Public Outreach

We will continue to update the FAST EPO web page and collect statistics on its use. We will write up a report on the three years of web statistics. We will put the 9-14 grade electric field lesson on the web together with feedback forms for the teachers to fill out. These lessons will also be located on the SEGway web page with the lessons developed by other mission E/PO teams.

We will continue to attend public outreach events as in the previous year, again attending Cal Day at UCB open-house in April 2006.